

Leniency Programs in a Multimarket Setting: Amnesty Plus and Penalty Plus*

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Abstract

We examine the effect of Amnesty Plus and Penalty Plus on firms' initial self-reporting decision, in one market, by altering their whistle-blowing incentives in another market. Amnesty Plus and Penalty Plus are proactive US strategies which aim at triggering multiple confessions by increasing the incentives of already convicted firms to report in a second market where they collude. Predictably, conditional on the conviction of one cartel, Amnesty Plus and Penalty Plus strengthen firms' incentives to report the remaining cartel. However, Amnesty Plus and Penalty Plus have an ambiguous impact on firms' incentives to apply for amnesty in the first place: On the one hand, Amnesty Plus and Penalty Plus may help to sustain a cartel, otherwise reported under the EC Leniency Program. On the other hand, Amnesty Plus and Penalty Plus may induce immediate reporting of both cartels whereas only one of them would have been reported under the EC Leniency Program.

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“Good experience with citric acid. Next opportunity [vitamin] B2. We think it’s worth that we explore all possibilities of cooperation. Let’s explore cooperation product-by-product.” (Kuno Sommer, Hoffmann-La Roche, quoted in New York Times 10/10/99)

1 Introduction

This paper studies the potential of leniency - respectively amnesty - programs allowing for *Amnesty Plus* and *Penalty Plus* to create incentives for companies, which are simultaneously participating in multiple cartel activities, to reveal the entire range of their antitrust offenses.

Experience garnered over many years has taught antitrust authorities in the United States (US) and the European Union (EU) that companies which have been colluding in one specific product or geographic market are more likely to have engaged in, or at least to know about, cartel activities in other adjacent markets. Due to the high diversity of businesses in multinational firms, price fixing and market allocation conspiracies bear all the marks of contagion between and especially within companies. The cross-linked conspiracy pattern in various vitamins, citric acid and lysine is a well-known subject matter and illustrates this claim: During ten years, Hoffmann-La Roche (HLR) was simultaneously active in virtually all cartels affecting the whole extent of bulk vitamin production, i.e. vitamins A, E, B1, B2, B5, B6, folic acid, C, D3, H, beta carotene and carotinoids. The first main group of cartels consisted of price fixing agreements in the markets for vitamin A and E between HLR, BASF and Rhône-Poulenc. The initial success of these arrangements inspired their replication in other vitamin markets. In these second-wave cartels, firms such as Merck, Takeda and Daiichi, simultaneously colluding in at least one other vitamin, joined the pioneers (Connor, 2000). While Rhône-Poulenc’s disclosure of evidence on collusion in the vitamin A and E markets made the cartel’s wall of silence crumble, only BASF’s comprehensive collaboration with the US Department of Justice (DoJ) under the Amnesty Plus Program accelerated inquiries and finally led to the successful prosecution of all participants. Accordingly, the European Commission (EC) stated that “the simultaneous existence of the collusive arrangements in the various vitamins was not a spontaneous or haphazard development, but was conceived and directed by the same persons at the most senior levels of the companies concerned”¹. Surprisingly, when Rhône-Poulenc plead guilty to its vitamin conspiracies under the US Amnesty Program and applied for leniency under the 1996 EC Leniency Notice, it pursued cartel activities in methionine and methylglucamine².

¹EC IP/01/1625 November 2001.

²EC IP/01/1625 November 2001, EC IP/02/976 July 2002, EC IP/02/1746 November 2002.

During the vitamin conspiracy, HLR was acting as a co-leader of the citric acid cartel, the world's most widespread acidulent and preservative used in the food and beverage industry, at the side of Archer Daniels Midland (ADM). In 1997, at the time of HLR's conviction under the US antitrust law for its participation in the citric acid conspiracy, the Division informed the company about the ongoing investigations in the vitamin market and even asked for its cooperation in return for lenient treatment. However, instead of assisting the DoJ in its inquiries, not only did HLR's top executives, engaged in the citric acid conspiracy and holding at the same time important responsibilities in the vitamin business, boldly deny any knowledge of, or participation in, a vitamin cartel, but also they sharply increased their efforts to conceal illegal arrangements (Hammond, 2000; Barboza, 1999). In 1997, shortly after ADM had plead guilty for criminal price fixing in citric acid, HLR and Jungbunzlauer AG (JBL) agreed to plea-bargain and to pay fines totaling \$25 million. At the same time, ADM and JBL engaged in price fixing and market sharing in sodium gluconate³.

In 1995, two years before the citric acid cartel was exposed, dawn raids in the headquarters of ADM, the largest US processor of agricultural commodities, produced hard evidence of collusive arrangements in lysine, an essential amino acid. This investigation directly led to the citric acid cartel when authorities found documents and video tapes which contained references to the conspiracy in citric acid. The illegal price fixing and market sharing agreements in lysine⁴ were initiated by ADM in 1992 and discovered by the public in 1995 (Connor, 2000). Besides ADM were involved its Asian rivals Ajinomoto, Cheil, Kyowa and Sewon. In 1996, the Asian lysine producers plead guilty and agreed to cooperate with the DoJ and to testify against ADM in return for lenient treatment. Just after the adoption of the 1996 EC Leniency Notice, Ajinomoto decided to inform the EC on the cartel and qualified for a 50% discount in fines. At the time Ajinomoto came forward, it was involved in another global conspiracy in the market for nucleotides⁵ lasting until mid 1996 when it was unveiled by its accomplice Takeda, itself under investigation for participation in the vitamin cartel case.

In the US, convictions of global cartels in the 1990s suggest that at least a dozen firms have become repeated offenders in related product industries (Connor, 2003). The DoJ has been investigating around 50 alleged international cartels in 2004, and half of them have been detected during inquiries on separate markets (Hammond, 2004). These so-called 'rolling investigations' and 'cartel profiling' techniques are the DoJ's response to companies' recidivism. With the objective of fully exploiting the multimarket contact between colluding firms, the DoJ implemented the Amnesty - respectively Penalty - Plus

³EC IP/01/1743 December 2001, IP/01/1355 October 2001.

⁴EC IP/00/589 June 2000.

⁵EC IP/02/1907 December 2002.

Program in 1999 as part of the Division’s Corporate Leniency Policy (Spratling, 1999). According to Hammond, “The Division’s Amnesty Plus program creates an attractive inducement for encouraging companies who are *already under investigation* to report the full extent of their antitrust crimes [...]” (Hammond, 2004:16).

Leniency programs reduce fines for cartel members that bring evidence to the antitrust authority. Amnesty refers to the complete exemption from fines. Amnesty Plus and Penalty Plus comprise proactive strategies aimed at attracting amnesty applications by encouraging subjects of ongoing investigations to consider whether they qualify for amnesty in other than currently inspected markets where they engage in cartel activities. Amnesty Plus offers a firm which currently plea-bargains an agreement for participation in one illegal antitrust activity, where it cannot obtain guaranteed amnesty, complete immunity in a second cartel affecting another market. Provided that the firm agrees to fully cooperate in the investigation of the conspiracy of which the DoJ was previously not aware, it is automatically granted amnesty for this second offense. Moreover, the company benefits from a substantial additional discount, i.e. the Plus, in the calculation of its fine in any plea agreement for the initial matter under investigation⁶. The counterpart of Amnesty Plus is Penalty Plus, or equivalently “If Amnesty Plus is the carrot, ‘Penalty Plus’ is the stick.” (Jarett Arp and Spratling, 2003:29). If companies that neglect to take advantage of Amnesty Plus are nevertheless caught for a second time, their behavior is more severely fined than it would otherwise merit. The company’s knowing failure to report aggravates the punishment, not only increasing the size of the fine but also the length of the jail sentence for its executives⁷.

Under the current EC Leniency Notice, Amnesty Plus and Penalty Plus do not exist. Although, in 2001, the Organization for Economic Co-operation and Development (OECD) recommended the inclusion of Amnesty Plus as part of the 2002 reforms of the EC Leniency Program, the EC did not seize the opportunity to follow the US example by introducing a similar policy.

The objective of the analysis is to examine the effect of Amnesty Plus and Penalty Plus on firms’ initial self-reporting decision, in one market, by altering their whistle-blowing incentives in another market. Unsurprisingly, conditional on cartel conviction in

⁶The size of the additional discount mainly depends on three factors: The strength of the evidence provided by the cooperating company, the potential significance of the revealed case measured in terms of volume of commerce involved, geographic scope and the number of co-conspirators, and the likelihood that the DoJ would have detected the cartel absent self-reporting (Hammond, 2006).

⁷The DoJ does not state an exact percentage increase in the case of Penalty Plus but asserts to pursue a fine or jail sentence at or above the upper end of the Guidelines Range (Hammond, 2006). An example of Penalty Plus is the DoJ’s fining decision in monochloroacetic acid in 2003. The German company Hoechst AG was fined roughly 130% above the minimum guideline fine due to its failure to report the illegal agreement in monochloroacetic acid at the time it was convicted for its participation in the sorbates cartel (Hammond, 2004).

one of the markets, Amnesty Plus and Penalty Plus strengthen firms' reporting incentives in the other market. However, Amnesty Plus and Penalty Plus have an ambiguous impact on firms' incentives to apply for amnesty in the first place: On the one hand, firms are less willing to denounce a cartel, otherwise reported under the EC Leniency Program, if this would entail revelation of a second cartel; especially if the latter is very profitable. In particular, if, by reporting one of their infringements, firms have to sacrifice sufficiently high expected cartel profits in the other market, Amnesty Plus and Penalty Plus help to sustain collusion in both markets. Moreover, since the beneficial effect of Amnesty Plus and Penalty Plus operates only after a conviction in one market, less spontaneous reporting may compromise the very functioning of this policy. On the other hand, Amnesty Plus and Penalty Plus may also lead to immediate self-reporting in both markets. Firms, fearing that, after reporting one, their partner reveals the other cartel, would prefer to forthwith report both cartels. This desirable effect occurs if expected cartel profits in one market are not sufficient to compensate for forgoing leniency in the other market. We base our arguments on an analysis of a two-stage game between two symmetric firms which simultaneously collude in two distinct product markets, say A and B , and consider the revelation of these cartels taking into account the enforcement policy of the Antitrust Authority (AA). To act as a benchmark, we initially examine firms' reporting incentives under a standard amnesty policy which comprises neither Amnesty Plus nor Penalty Plus as it currently is in force in the EU. Then, we analyze how these revelation incentives change under a US style amnesty policy where Amnesty Plus exists. Finally, we add Penalty Plus and show that not only our results still hold but also Penalty Plus may even strengthen our findings.

The study of the possible impact of Amnesty Plus and Penalty Plus on firms' incentives to self-report has been exclusively left to legal scholars. Jephcott (2002) is first to highlight the lack of an equivalent to the US Amnesty Plus option in the 2002 EC Leniency Notice. McElwee (2004) argues that Amnesty Plus and Penalty Plus intensify the 'race to the courtroom' dynamics⁸ and thus generate distrust among cartel members. Moreover, companies volunteering information on their participation in other cartels during an investigation on a distinct product or geographic market appear to be rare. This seems especially true for antitrust regimes under which the altruism of companies is not substantially rewarded. Even though exceptions may occasionally exist⁹, the author

⁸Under the US Amnesty Program, only the first reporting firm is eligible to full immunity from fines. The so-called 'winner-takes-it-all' approach sets up a race among firms competing for being first to denounce the cartel to the AA.

⁹In the Belgian Beer Brewers' cartel, Interbrew, one of the colluding companies under investigation, spontaneously disclosed a simultaneously existing illegal agreement between Luxembourg brewers though it could not benefit from an additional fine discount in the Belgian Beer market, e.g. for particularly extensive cooperation, as it would have under US Amnesty Plus (EC IP/01/1739 December 2001, EC IP/01/1740 December 2001).

recommends the introduction of a leniency policy similar to the US Amnesty Plus and Penalty Plus in Europe.

Although the law literature on the subject is burgeoning, to our knowledge, there is no economic analysis which tries to clarify possible motifs for the EC's non-adoption of Amnesty Plus and Penalty Plus, let alone to model the role of leniency programs when companies commit multiple antitrust offenses. We take the first step towards filling this gap in economic theory on leniency programs.

The remainder of the paper is organized as follows. Section 2 briefly reviews the economic literature related to our analysis. Section 3 sets up the model. Section 4 analyzes the second stage of the revelation game and its equilibrium outcomes. The first stage of the game is examined in section 5. Section 6 considers Penalty Plus and shows how it affects our findings. Section 7 concludes.

2 Related Literature

The enforcement problem we study essentially relates to two different strands of literature. On the one hand, our paper is embedded in the analysis of how the design of leniency programs influences the internal stability of collusive agreements involving a group of violators. On the other hand, our analysis is motivated by the study of how multimarket contact affects the degree of cooperation among firms.

Our analysis is closest in purpose to current economic leniency literature in that we attempt to assess how the design of leniency programs affects cartel stability. Recent academic research - such as Aubert, Kovacic and Rey (2006), Harrington (2005), Motta and Polo (2003) and Spagnolo (2003) - has elaborated on the differences in conception of leniency programs and their impact on the efficacy of antitrust enforcement¹⁰.

Our model differs from previous work, where firms collude in one market only, in that we consider firms which simultaneously participate in several collusive agreements. Spagnolo (2003), by modeling harsher fines for recidivist firms, is the only study on leniency programs which touches upon recidivism. Higher sanctions for recurrent antitrust offenders rationalize the use of reduced fine schemes when firms follow an optimal two-phase punishment. Reporting raises fines and reduces expected profits from further collusion, limiting the costs firms are willing to incur to punish the whistleblower defecting from the cartel in the first place. However, whereas in our analysis we capture the idea of recidivism by the firms' opportunity, following a successful investigation in one market, to continue price fixing in another market, the author does not consider firms which simultaneously are involved in multiple cartel activities.

¹⁰For an extensive overview of economic literature on leniency programs see Spagnolo (2006).

Motchenkova and van der Laan (2005) are first to explicitly acknowledge the importance of firms' multimarket operations within a leniency framework. They use the multimarket context in order to examine the effectiveness of leniency rules, given that firms, admitting their collusive conduct, incur costs other than fines. These additional costs are modeled as the loss in sales in markets, other than the one involved in illegal behavior, due to negative reputation effects following a cartel conviction. Although in their model firms operate in several markets, they form a cartel in one market only. Moreover, the focus of the study is on the strictness of leniency programs reflecting the likelihood of getting full immunity from fines even in case many firms self-report simultaneously and hence, it fundamentally differs from ours.

Another noteworthy difference from the above literature is that, in our model, cartels do not take the form of ongoing criminal relations. This is in line with Feess and Walzl (2004) who develop a static model to compare leniency policies in the US and the EU¹¹, and Spagnolo (2000) who examines anticompetitive effects of leniency programs in one-shot market interactions. Although our model is static, the intuition behind the results is likely to apply also to dynamic environments.

Finally, most of the leniency literature focuses on the potential of leniency programs to deter collusion *ex ante*. We presume that cartels have already been formed and instead concentrate on the issue of *ex post* desistance. However, since greater desistance makes collusion less profitable, desistance is pertinent to deterrence and thereby enhances *ex ante* deterrence. This is in line with Harrington (2005).

Our analysis has essentially been inspired by the literature on collusion in a multi-market context which started with the seminal paper of Bernheim and Whinston (1990). The authors build on the idea, first raised by Edwards (1955) and further developed in a finite oligopoly games context by Harrington (1987), that multimarket contact across firms may foster anticompetitive outcomes. Bernheim and Whinston (1990) show that strategically linking markets weakly increases cartel profits because it slackens the incentive constraints that limit firms' ability to sustain collusive behavior in settings of repeated interactions. Their technical result coincides with the intuition that multi-market contact allows for linkage-induced punishment which can deter deviations from collusive behavior.

Apart from the main idea of the above studies, namely that multimarket contact between firms may influence collusive outcomes, the setup of our model is different in that we abstract from repeated interactions between colluding firms and do not examine the cartel formation stage of the game. Moreover, in our analysis, multimarket contact

¹¹Feess and Walzl (2004) focus on differences with respect to e.g. the relevance of the amount of evidence provided in the determination of the fine reductions and the number of firms eligible to leniency. They do not address the issue of Amnesty Plus and Penalty Plus.

alone does not affect collusive behavior. It is Amnesty Plus and Penalty Plus which create the link between firms' reporting decisions in the markets where they collude.

3 The Model

3.1 Basic Assumptions

We analyze the interaction between two symmetric firms, F1 and F2, which are simultaneously engaged in cartel activities in two distinct product markets, A and B , and which consider the revelation of these cartels taking into account the enforcement activity of the AA. Markets A and B may differ in size and profitability. We compare firms' revelation decisions under the EC Leniency and the US Amnesty Program whose sole difference here is that the latter allows for Amnesty Plus and Penalty Plus. Amnesty Plus signifies that a firm which has been caught colluding in one market, either through reporting of its co-conspirator or through the investigation efforts of the AA, can avoid the full fine in this market by reporting the remaining cartel in the other market. Penalty Plus increases the fine for a recidivist firm.

The strictness of the enforcement policy is summarized by independent market-specific investigation probabilities, q_A and q_B , with which the AA opens an inquiry leading to the conviction of colluding firms with certainty¹². At the time firms decide to enter an illegal agreement, they cannot directly observe prevailing investigation probabilities. However, firms conjecture the strictness of the AA's enforcement policy based on a market-specific combination of observable variables which determine current antitrust policy. Firms' ex ante conjectures of detection probabilities, \bar{q}_A and \bar{q}_B , are the expected values of ex post realizations. As we focus on desistance, we presume that, before the start of the game, these conjectures are such that firms find it profitable to form a cartel in each of the markets. However, probabilities of being convicted may change over time. Potential reasons could be complaints from consumers, employees revealing information to the AA, a shift in the AA's budget constraint which affects available resources and efforts devoted to antitrust enforcement in the different product markets or simply changes in the way the AA operates. The change in detection probabilities acts as an exogenous shock on the expected profitability of a cartel and may prompt firms to reconsider their decision to collude.

Following an increase in detection probabilities, firms simultaneously decide whether to self-report or not, S , respectively NS , as a function of conviction probabilities, cartel profits and fines. Let us denote Π_A , respectively Π_B , the cartel profits in market

¹²To keep the model simple, we identify investigation and conviction with a single probability. However, one could introduce uncertainty with respect to the AA's ability to prove guilty a detected cartel without affecting the results (see e.g. Motta and Polo (2003)).

A , respectively B , and Π_N the non-cooperative Bertrand-Nash profit obtained during compliance with the law in each market. Without loss of generality, we set $\Pi_N = 0$ and assume that $\Pi_A, \Pi_B > 0$.

3.2 Enforcement Choices

The AA commits to its enforcement policy by setting

- the full fine F_A , respectively F_B , per cartel detected and successfully prosecuted, imposed on a non-reporting firm. The size of the fine is exogenously given by law.
- the reduced fine for a self-reporting firm equal to 0. Only the first self-reporting firm is eligible to amnesty. The latecomer pays the full fine. When both firms report simultaneously, each is first in 50% of the time.
- the increased fine $(1 + \alpha)F_A$, respectively $(1 + \alpha)F_B$, under Penalty Plus where $\alpha > 0$. The parameter α reflects the increase in the fine a firm has to pay when convicted in one market after prior detection in another market.
- the supplementary reduction in fines under Amnesty Plus equal to the entire fine previously imposed.

3.3 Timing

The model is static. There is only one period which is divided into two stages. Before the start of the game, at the beginning of period zero, the AA commits to its fining policy. At the same time, Nature chooses the order in which a possible investigation takes place, and firms observe this. If no cartel has been reported, the AA first investigates and discovers A with probability q_A before starting an inquiry in B with probability q_B . When forming a cartel, firms conjecture market-specific conviction probabilities \bar{q}_A and \bar{q}_B . These conjectures are low enough to make firms collude in both markets. At the end of period zero, both firms receive market-specific signals which make them revise their subjective detection probabilities from $\bar{q}_{A,B}$ to $q_{A,B}$. Subjective probabilities are identical for both firms. The shift in detection probabilities might make firms consider whether they wish to spontaneously report one or both cartels to the AA. If $q_{A,B} \leq \bar{q}_{A,B}$, collusion is still profitable and firms have no incentives to desist from cartel activities by revealing information to the AA. Thus, the only cases relevant to our analysis result from an investigation probability increase such that $q_{A,B} > \bar{q}_{A,B}$ in at least one of the markets. Figure 1 shows the time structure of the game.

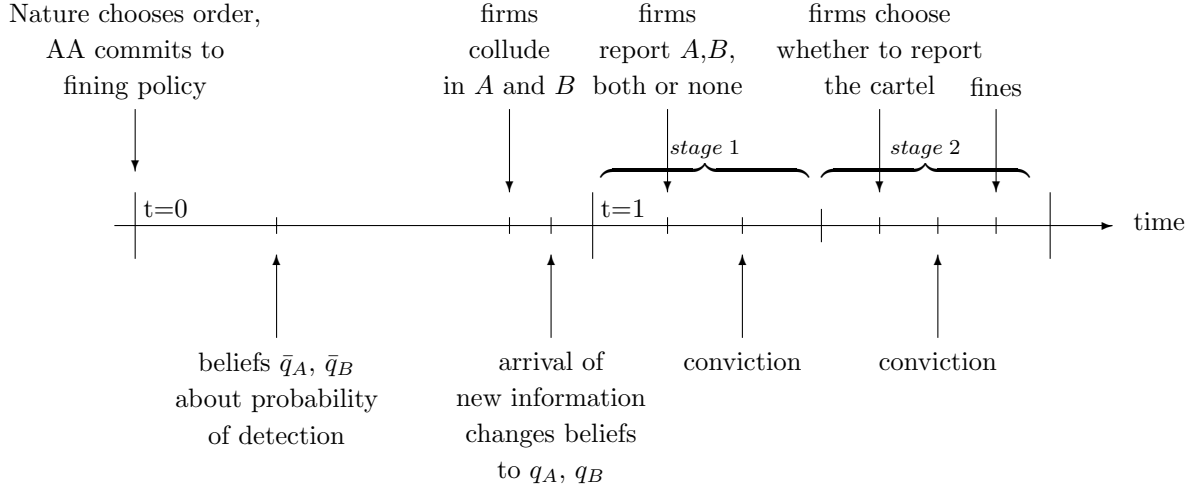


Figure 1: Time Line

Stage 1: Revelation Decision in Both Markets. Firms simultaneously decide whether to report one, both or none of the cartels.

- If both cartels are reported, the AA convicts each cartel with certainty. The game does not reach stage 2.
- If only one cartel is reported, the AA convicts this cartel with certainty, and the game moves on to stage 2.
- If firms do not reveal any information, the AA detects the cartel in A with probability q_A , and firms may want to reconsider their decision whether or not to report the cartel in B . Hence, if the AA convicts the cartel in A , the game moves on to stage 2. With probability $1 - q_A$, the cartel in A remains undetected, and the game does not reach stage 2. In this case, the AA investigates and detects the cartel in B with probability q_B .

Stage 2: Reconsideration of the Revelation Decision. The game only reaches stage 2 if one of the cartels has survived stage 1. Firms simultaneously decide whether to report the cartel in the market where the AA has not yet launched an investigation.

- If firms do not report, the AA convicts the cartel with probability q_A , respectively q_B .
- If at least one of the firms self-reports, the AA convicts the cartel with certainty.

4 Reporting Decision in Stage 2

4.1 EC Leniency Program without Amnesty Plus and Penalty Plus

When analyzing stage 1 in section 5, we will be interested in unilateral deviations from cooperation. Therefore, we fix the collusive behavior of F1 in stage 1. The game reaches stage 2 only after one cartel conviction in stage 1 and thus, there are three different scenarios which lead to stage 2. First, neither firm reports, but the AA investigates and detects the cartel in A which happens with probability q_A . Second, F2 denounces the cartel in A but keeps secret the cartel in B . Finally, F2 reveals the cartel in B but sticks to the collusive agreement in A . Proceeding by backward induction, we examine the normal form of the revelation game in stage 2 after each possible outcome in stage 1. We only consider pure strategy Nash Equilibria (NE). Both firms reporting constitutes a NE only if, for given fines and cartel profits, the probability of being convicted in stage 2 exceeds the probability threshold which makes a unilateral deviation from cooperation just unprofitable. A firm which reports the cartel in stage 2, while its partner adheres to cooperation, makes zero profits and pays no fine. Thus, the critical investigation probability is such that the expected profits from the remaining cartel are zero. Figure 2 depicts this situation under the EC Leniency Program.

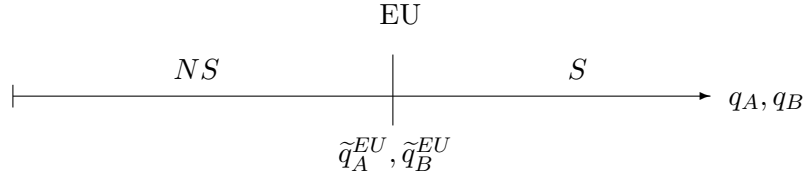


Figure 2: Stage 2 Reporting Decisions in the EU

Above the threshold, expected profits in stage 2 are negative, and firms simultaneously report the cartel. The outcome (S, S) is the unique NE. However, below the critical probability, (S, S) and (NS, NS) are both NE, but the latter Pareto dominates the former. If the game has two NE, firms coordinate on the Pareto dominating outcome and therefore do not self-report.

To determine the thresholds, we first consider the situation where firms did not report any of the cartels in stage 1, but the AA detected the cartel in A all the same. The payoff matrix in Table 1 summarizes the revelation game played in stage 2. F1's possible actions are reported vertically, and those of F2 horizontally. Setting $\Pi_N = 0$, the outcome (S_B, S_B) is the unique NE only if $q_B > \frac{\Pi_B}{\Pi_B + F_B} = \tilde{q}_B^{EU}$. Firms may get

caught in the cartel activity, earn zero profits and pay a fine with a high probability. Therefore, expected cartel profits are negative which makes a unilateral deviation from the cooperative NE attractive.

$\downarrow F1, F2 \rightarrow$	S	NS
S	$2\Pi_N - F_A - \frac{1}{2}F_B$	$2\Pi_N - F_A$
NS	$2\Pi_N - F_A - F_B$	$\Pi_N - F_A + q_B(\Pi_N - F_B) + (1 - q_B)\Pi_B$
	$2\Pi_N - F_A$	$\Pi_N - F_A + q_B(\Pi_N - F_B) + (1 - q_B)\Pi_B$

Table 1: Stage 2 EC Revelation Game after $(NS_A NS_B, NS_A NS_B)$ in Stage 1

Second, consider the payoff matrix in Table 2 which summarizes the revelation game played in market B in stage 2 after F2 reported the cartel A in stage 1. Again, expected cartel profits are negative, and the outcome (S_B, S_B) is the unique NE only if $q_B > \frac{\Pi_B}{\Pi_B + F_B} = \tilde{q}_B^{EU}$.

$\downarrow F1, F2 \rightarrow$	S	NS
S	$2\Pi_N - F_A - \frac{1}{2}F_B$	$2\Pi_N - F_A$
NS	$2\Pi_N - F_A - F_B$	$\Pi_N - F_A + q_B(\Pi_N - F_B) + (1 - q_B)\Pi_B$
	$2\Pi_N$	$\Pi_N + q_B(\Pi_N - F_B) + (1 - q_B)\Pi_B$

Table 2: Stage 2 EC Revelation Game after $(NS_A NS_B, S_A NS_B)$ in Stage 1

Finally, given that F2 already reported the cartel B in stage 1, the payoff matrix in Table 3 summarizes the revelation game played in market A in stage 2. The outcome (S_A, S_A) is the unique NE only if $q_A > \frac{\Pi_A}{\Pi_A + F_A} = \tilde{q}_A^{EU}$.

$\downarrow F1, F2 \rightarrow$	S	NS
S	$2\Pi_N - F_B - \frac{1}{2}F_A$	$2\Pi_N - F_B$
NS	$2\Pi_N - F_B - F_A$	$\Pi_N - F_B + q_A(\Pi_N - F_A) + (1 - q_A)\Pi_A$
	$2\Pi_N$	$\Pi_N + q_A(\Pi_N - F_A) + (1 - q_A)\Pi_A$

Table 3: Stage 2 EC Revelation Game after $(NS_A NS_B, NS_A S_B)$ in Stage 1

An increase in the fine a non-reporting firm would have to pay in the case of a conviction in stage 2 decreases the investigation probability needed to induce self-reporting. On the contrary, higher cartel profits in stage 2 raise the critical probability thresholds.

4.2 US Amnesty Program with Amnesty Plus

The analysis is analogous to the EU. The same three scenarios in stage 1 lead to stage 2. Each of them involves one cartel conviction in stage 1. However, firms' payoffs from unilateral deviations and with them their reporting incentives in each subgame change with respect to the EU benchmark case. Since Amnesty Plus links markets, the outcome in market A affects reporting decisions in market B . A firm, once convicted in market A , has stronger incentives to denounce the cartel in market B to avoid the fine in A . Thus, the collusive NE is easier to break than under the EU policy where markets are independent, and where actions taken in one of the markets do not affect firms' decisions in the other market. Figure 3 shows the probability thresholds in the US.

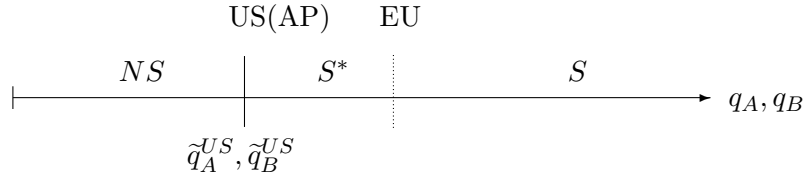


Figure 3: Stage 2 Reporting Decisions in the US, Amnesty Plus

Above the critical probability, firms report the cartel in stage 2. The threshold is lower and thus, the probability range for which the outcome (S, S) is the unique NE is larger in the US than in the EU. In the region S^* , the EC Leniency Program would have sustained the cooperative NE whereas in the US, Amnesty Plus offers a profitable deviation to a firm which has been fined in stage 1. Therefore, conditional on conviction in stage 1, Amnesty Plus enhances reporting in stage 2. Still, below the critical probability, firms coordinate on the cooperative outcome and do not report the remaining cartel.

To compute the thresholds, we first consider the payoff matrix in Table 4 which summarizes the revelation game played in stage 2 when the AA caught both firms colluding in A in stage 1. The outcome (S_B, S_B) is the unique NE only if $q_B > \frac{\Pi_B - F_A}{\Pi_B + F_B} = \tilde{q}_B^{US}$.

Second, given that F2 reported the cartel A in stage 1, the payoff matrix in Table 5 summarizes the revelation game played in market B in stage 2. In this case, Amnesty

$\downarrow F1, F2 \rightarrow$	S	NS
S	$2\Pi_N - \frac{1}{2}(F_A + F_B)$	$2\Pi_N$
NS	$2\Pi_N - \frac{1}{2}(F_A + F_B)$ $2\Pi_N - F_A - F_B$	$2\Pi_N - F_A - F_B$ $\Pi_N - F_A + q_B(\Pi_N - F_B) + (1 - q_B)\Pi_B$ $\Pi_N - F_A + q_B(\Pi_N - F_B) + (1 - q_B)\Pi_B$

Table 4: Stage 2 US Revelation Game after $(NS_A NS_B, NS_A NS_B)$ in Stage 1

Plus strengthens F1's incentives to report the cartel in B and as whether the cartel is convicted depends only on the incentives for at least one firm revealing, the relevant critical investigation probability is associated with the non-reporting condition for F1. Again, the outcome (S_B, S_B) is the unique NE only if $q_B > \frac{\Pi_B - F_A}{\Pi_B + F_B} = \tilde{q}_B^{US}$.

$\downarrow F1, F2 \rightarrow$	S	NS
S	$2\Pi_N - \frac{1}{2}(F_A + F_B)$	$2\Pi_N$
NS	$2\Pi_N - \frac{1}{2}F_B$ $2\Pi_N - F_B - F_A$ $2\Pi_N$	$2\Pi_N - F_B$ $\Pi_N - F_A + q_B(\Pi_N - F_B) + (1 - q_B)\Pi_B$ $\Pi_N + q_B(\Pi_N - F_B) + (1 - q_B)\Pi_B$

Table 5: Stage 2 US Revelation Game after $(NS_A NS_B, S_A NS_B)$ in Stage 1

Finally, the payoff matrix in Table 6 summarizes the revelation game played in market A in stage 2 when F2 reported the cartel B in stage 1. By reporting the cartel in A , F1 may benefit from Amnesty Plus and thus, the relevant threshold is associated with F1's deviation incentives. Hence, the outcome (S_A, S_A) is the unique NE only if $q_A > \frac{\Pi_A - F_B}{\Pi_A + F_A} = \tilde{q}_A^{US}$.

$\downarrow F1, F2 \rightarrow$	S	NS
S	$2\Pi_N - \frac{1}{2}(F_A + F_B)$	$2\Pi_N$
NS	$2\Pi_N - \frac{1}{2}F_A$ $2\Pi_N - F_B - F_A$ $2\Pi_N$	$2\Pi_N - F_A$ $\Pi_N - F_B + q_A(\Pi_N - F_A) + (1 - q_A)\Pi_A$ $\Pi_N + q_A(\Pi_N - F_A) + (1 - q_A)\Pi_A$

Table 6: Stage 2 US Revelation Game after $(NS_A NS_B, NS_A S_B)$ in Stage 1

All US probability thresholds are unambiguously lower than their counterparts in Europe. They decrease even further when the size of the fine a firm can avoid under Amnesty Plus increases.

5 Reporting Decision in Stage 1

When firms simultaneously decide whether and, if yes, which of the cartels to report in stage 1, they anticipate the NE played in stage 2. Figures 4 and 5 show firms' reporting decisions in the EU and the US. We identify four different regions common to the EU and the US. In the US, however, there are four more areas which do not exist under the EC Leniency Program. Each region corresponds to a particular combination of revelation choices in stage 1 and stage 2. Hatched regions indicate that, if the game reaches stage 2, firms report cartel in B .

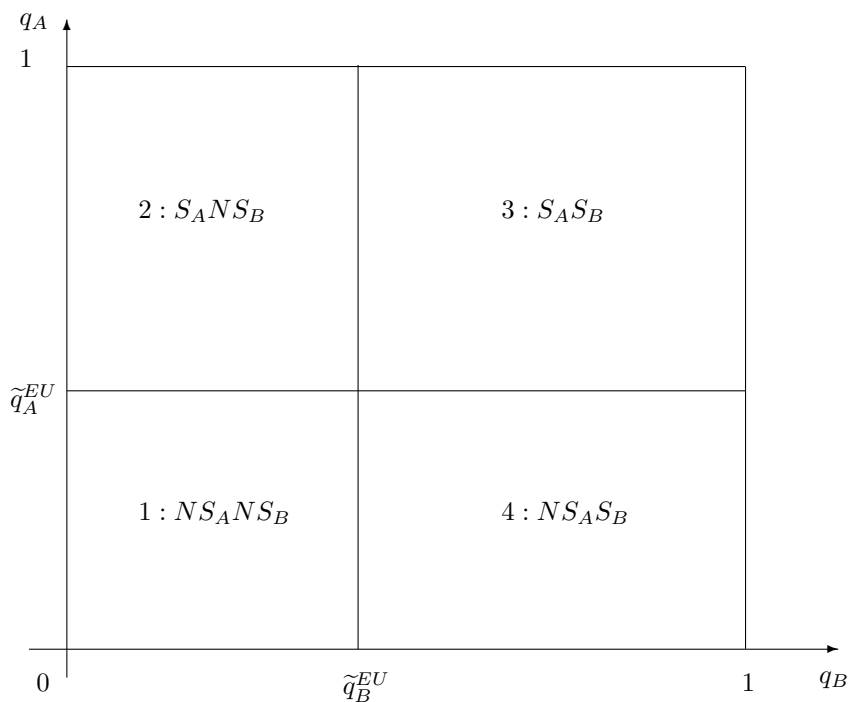


Figure 4: Stage 1 Reporting Decisions in the EU

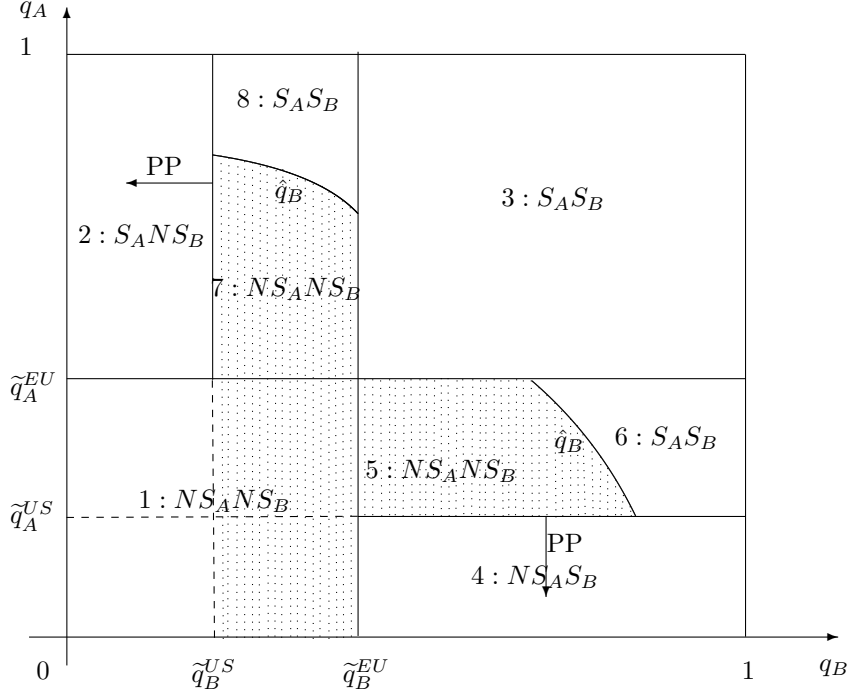


Figure 5: Stage 1 Reporting Decisions in the US

Region 1. Not Reporting of A and B: $q_B < \tilde{q}_B^{EU}$ and $q_A < \tilde{q}_A^{EU}$

Conviction probabilities fall below the EU thresholds, and expected cartel profits are positive in both markets. Thus, in the EU, conjectured investigation probabilities are too small to induce self-reporting. Firms neither report any of the cartels in stage 1, nor reconsider their decision to report the cartel in B in stage 2 after the AA has detected the cartel in A .

In the US, there are two different cases: First, assume the conviction probability in B falls between the US and the EU thresholds. Firms anticipate that after a conviction in market A , they report the cartel in B . Second, assume that the conviction probability in B is lower than the US threshold. Then, even in the US, firms do not have any incentives to report the cartel in B after the detection of A in stage 1. In both cases, expected cartel profits in each of the markets are positive, and thus, firms have no incentives to report any of the cartels in stage 1.

Region 2. Revelation of Only A: $q_B < \tilde{q}_B^{US}$ and $q_A > \tilde{q}_A^{EU}$

The probability of conviction in A is above the EU threshold. The expected cartel profits in this market are negative. In the EU, firms report the cartel in A in stage 1. The reporting in A does not alter firms' whistle blowing incentives in B . As the probability of detection in B falls below the critical level in the US, reporting in A

does not entail reporting in B . Thus, firms in the US only report the unprofitable cartel A in stage 1.

Region 3. Revelation of A and B : $q_B > \tilde{q}_B^{EU}$ and $q_A > \tilde{q}_A^{EU}$

Conviction probabilities in both markets exceed the EU thresholds. Thus, firms do not find their cartels profitable on average. Consequently, in the EU as well as in the US, they report both cartels in stage 1. The AA convicts both cartels and grants amnesty to the first reporting firm. The other firm pays the full fine. The game does not reach stage 2.

Region 4. Revelation of Only B : $q_B > \tilde{q}_B^{EU}$ and $q_A < \tilde{q}_A^{US}$

Firms find detection in market B likely enough to make expected cartel profits negative, and thus, they would report the cartel in B in stage 1 under both policies. As the probability of detection in A falls below the critical level in the US, self-reporting in B does not entail reporting of the cartel in A in stage 2.

Regions 5&6. Revelation of both or none: $q_B > \tilde{q}_B^{EU}$ and $\tilde{q}_A^{US} < q_A < \tilde{q}_A^{EU}$

Regions 5 and 6 only exist in the US. In the EU, region 4 accounts for this case where both firms simultaneously report the cartel in B in stage 1 but continue colluding in A . Since the cartel in B gives negative expected profits, firms in the US would like to mimic their European counterparts and report the cartel in B in stage 1. However, firms in the US know that reporting in B in stage 1 entails reporting of the cartel in A in stage 2. Cartel A is profitable though, and firms are reluctant to report it which leaves them with two possible strategies: Either denounce both cartels in stage 1 or do not report at all in that stage and reveal the cartel in B in stage 2 only if the AA discovered the cartel in A by its mere efforts. By reporting both cartels in stage 1, a firm would try to get in with the amnesty application before its partner does, knowing that the cartel in A would be at latest disclosed in stage 2 under Amnesty Plus. Nevertheless, the maintenance of collusion in B may be, if not in market B taken individually, at least in markets A and B jointly beneficial because, by means of cooperation in B , firms can sustain the cartel in A . To determine which of the two strategies firms would choose, we locate the (q_A, q_B) -space where they find it profitable to switch from $NS_A NS_B$ to $S_A S_B$ ¹³. If firms do not report any of the cartels in stage 1, two possible states can occur: First, with probability q_A , the AA discovers the profitable cartel in A , and firms rush to report the unprofitable cartel in B in order to save the fine in

¹³The best possible deviation from $NS_A NS_B$ is $S_A S_B$. From a deviation to $NS_A S_B$ the deviating firm gets $2\Pi_N - \frac{1}{2}F_A < 2\Pi_N$ because, after reporting in B , firms would simultaneously apply for Amnesty Plus in stage 2. A deviation to $S_A NS_B$ is clearly not optimal because this means reporting the profitable market and keeping the unprofitable one.

A^{14} . Second, with probability $1 - q_A$, the AA does not find the cartel in A , stage 2 is not reached, and the cartel in B is detected with probability q_B . The expected profits from S_AS_B are higher than those from NS_ANS_B if

$$q_A \left[2\Pi_N - \frac{1}{2}(F_A + F_B) \right] + (1 - q_A) \left[\Pi_A + q_B(\Pi_N - F_B) + (1 - q_B)\Pi_B \right] < 2\Pi_N$$

Setting $\Pi_N = 0$, this is equivalent to

$$q_B > \frac{\Pi_A + \Pi_B}{\Pi_B + F_B} - \frac{1}{2} \frac{q_A}{(1 - q_A)} \frac{(F_A + F_B)}{(\Pi_B + F_B)} = \hat{q}_B$$

The above condition states that, if, for a given q_A , the AA is likely to detect the cartel in B , expected profits in this market are very negative, and firms find it too costly to sustain the cartel in B solely to preserve the cartel in A . This is what happens in region 6. There, Amnesty Plus has a desirable effect: Firms report both cartels in stage 1 whereas only one of them would have been reported in the EU. Moreover, \hat{q}_B decreases and is concave in q_A which indicates that, the higher the probability the AA detects the cartel in A , the lower the probability of detection needed in B in order to induce reporting of both cartels in stage 1. On the contrary, if the conviction probability in B is too low, i.e. $q_B \leq \hat{q}_B$, Amnesty Plus is detrimental since it invigorates collusion in both markets whereas one cartel would have at least been reported under the EC Leniency Program. This situation corresponds to region 5.

Regions 7&8. Revelation of both or none: $\tilde{q}_B^{US} < q_B < \tilde{q}_B^{EU}$ and $q_A > \tilde{q}_A^{EU}$
Regions 7 and 8 only exist in the US. In the EU, this case falls in region 2. In market A , conviction is sufficiently likely to make expected cartel profits negative. As a consequence, firms would like to report the cartel in A while preserving positive expected cartel profits in B . In the US, however, firms anticipate that, if they report the cartel in A in stage 1, they will have to sacrifice their cartel profits in B in stage 2. Therefore, firms' optimal strategy would be either to immediately disclose both cartels or not to report at all. By keeping secret the cartel in A firms are able to sustain the cartel in B . Firms deviate from NS_ANS_B to S_AS_B if their expected profits from the latter option are higher. The condition is the same as above and thus, if $q_B \leq \hat{q}_B$, firms play NS_ANS_B rather than S_AS_B in stage 1. This corresponds to regions 7 and 8 respectively.

¹⁴Then each of the firms can get Amnesty Plus with 50% chance and thus pays no fine, respectively both fines in 50% of the cases.

6 Penalty Plus

Penalty Plus severely punishes firms which are caught colluding in stage 2 after a cartel conviction in stage 1 by increasing the fine to $(1 + \alpha)F_A$, respectively $(1 + \alpha)F_B$. As a consequence, expected profits from cartel behavior in stage 2 decrease and thus, Penalty Plus reinforces the beneficial effect of Amnesty Plus in this stage. The fear of harsher fines further lower the probability threshold above which the (S, S) outcome is the unique NE. Figure 6 shows the thresholds after the inclusion of Penalty Plus and compares the situation to the EU and the US with only Amnesty Plus.

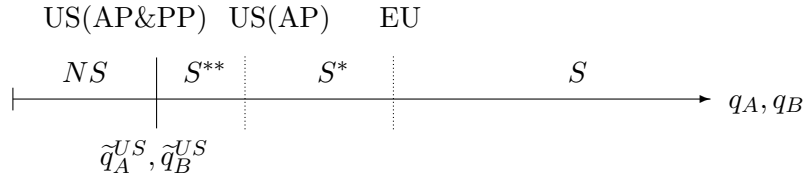


Figure 6: Stage 2 Reporting Decisions in the US, Amnesty Plus and Penalty Plus

Penalty Plus enlarges the probability range for which firms report the second infringement in stage 2 by S^{**} at the expense of the zone where (NS, NS) is the Pareto dominating NE. Arrows indicate this shift in Figure 5. To determine the relevant thresholds, we substitute F_B for $(1 + \alpha)F_B$ in the payoffs of Tables 4 and 5 and F_A for $(1 + \alpha)F_A$ in Table 6 and compute the probabilities for which a unilateral deviation is just unprofitable. We find that the critical probabilities decrease to $\frac{\Pi_B - F_A}{\Pi_B + (1 + \alpha)F_B} = \tilde{q}_B^{US}$ and $\frac{\Pi_A - F_B}{\Pi_A + (1 + \alpha)F_A} = \tilde{q}_A^{US}$ after a conviction in market A and B respectively.

Penalty Plus also has a direct impact on firms' revelation incentives in stage 1 by increasing the expected fines when firms decide not to report at all. If the AA detects the cartel in A , firms would simultaneously apply for Amnesty Plus in market B . Each firm has a 50% chance to get the Plus in A and amnesty in B . The latecomer pays a higher fine under Penalty Plus. Thus, the threshold above which firms report both cartels already in stage 1 decreases to

$$\frac{\Pi_A + \Pi_B}{\Pi_B + F_B} - \frac{1}{2} \frac{q_A}{(1 - q_A)} \frac{(F_A + (1 + \alpha)F_B)}{(\Pi_B + F_B)} = \hat{q}_B$$

Ceteris paribus, for a given q_A , the probability of detection in B needed in order to induce immediate self-reporting already in stage 1 is lower than under Amnesty Plus alone. However, due to the decrease of the threshold in stage 2, the region where the $NS_A NS_B$ outcome happens may eventually be larger.

7 Conclusion

In this paper, we have analyzed the effect of Amnesty Plus and Penalty Plus on the incentives for companies, simultaneously engaged in multiple cartel activities, to reveal the whole extent of their antitrust offenses.

Our results have confirmed the intuition that Amnesty Plus and Penalty Plus enhance firms' incentives to report a cartel once they have been convicted for another illegal cartel agreement. However, we have shown that Amnesty Plus and Penalty Plus have an ambiguous impact on firms' incentives to apply for amnesty in the first place. On the one hand, firms, anticipating their rival's action in stage 2, are less willing to denounce a cartel, otherwise reported under the EC Leniency Program, if this move would entail revelation of the second cartel. Thus, Amnesty Plus and Penalty Plus may help to sustain collusion in both markets, especially if the second cartel gives firms high expected profits. On the other hand, Amnesty Plus and Penalty Plus may lead to immediate self-reporting in both markets. This outcome arises if a firm, fearing that, after reporting one, their partner may be first to reveal the other cartel, prefers to immediately report both cartels. In order for this desirable effect to occur, expected cartel profits in one market must be insufficient to compensate for forgoing leniency in the other market. Which of the effects prevails depends on the AA's enforcement policy.

Our analysis stresses an essential issue in leniency policy. Further research has to be done to embed this model in a dynamic framework taking into account the ongoing nature of the relationship between cartel members. Moreover, having understood the impact of the strategic linkages between markets generated by Amnesty Plus and Penalty Plus on firms' decisions in the revelation stage of the game, the effect on cartel formation remains to be explored.

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